Electronic Version
Stylesheet Version v1.1.1

Claims

[c1] 1. A method of operating a solid oxide fuel cell having an anode and a cathode, the method comprising:
forming a first mixture comprising molecular oxygen and a compound having formula 1:
CH_3-O-R.....1
wherein R is alkyl, aryl, alkaryl, or arakyl;
heating the first mixture to a sufficient temperature to form a second mixture comprising carbon monoxide and molecular hydrogen; and
contacting the anode of a solid oxide fuel cell with the second gaseous mixture.

[c2] 2. The method of claim 1 wherein the compound having formula 1 is dimethyl ether.

[c3] 3. The method of claim 2 wherein the second mixture further comprises methane.

[c4] 4. The method of claim 1 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 3.0.

[c5] 5. The method of claim 1 wherein the molar ratio in the first mixture of molecular oxygen to a compound having

formula 1 is from about 0.1 to about 1.0.

[c6] 6. The method of claim 1 wherein the first mixture is heated to a temperature of less than about 650°C.

[c7] 7. The method of claim 1 wherein the first mixture is heated to a temperature of at least about 450°C.

[c8] 8. The method of claim 1 wherein the first mixture is heated to a temperature of at least about 550°C.

[c9] 9. The method of claim 1 wherein the first mixture is heated to a temperature of from about 550°C to about 650°C.

[c10] 10. The method of claim 1 wherein the anode comprises a nickel-containing cermet.

[c11] 11. The method of claim 1 wherein the anode comprises a component selected from the group consisting of nickel mixed with gadolina doped ceria, nickel mixed with yttria doped ceria zirconia, or nickel mixed with yttria doped zirconia.

[c12] 12. The method of claim 1 wherein the first mixture is formed by combining air and the compound having formula 1.

[c13] 13. The method of claim 1 wherein R is a C_{1-6} alkyl.

[c14] 14. A method of operating a solid oxide fuel cell having an anode and a cathode, the method comprising:
forming a first mixture comprising air and dimethyl ether;
heating the mixture to a sufficient temperature to form a second mixture comprising carbon monoxide, methane, and molecular hydrogen; and
contacting the anode of a solid oxide fuel cell with the second gaseous mixture.

[c15] 15. The method of claim 14 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 3.0.

[c16] 16. The method of claim 14 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 1.0.

[c17] 17. The method of claim 14 wherein the first mixture is heated to a temperature of less than about 650°C.

[c18] 18. The method of claim 14 wherein the first mixture is heated to a temperature of at least about 450°C.

[c19] 19. The method of claim 14 wherein the first mixture is heated to a temperature of at least about 550°C.

[c20] 20. The method of claim 14 wherein the first mixture is

heated to a temperature of from about 550°C to about 650°C.

[c21] 21. The method of claim 20 wherein the anode comprises Ni-$Y_2 0_3$ stabilized ZrO_2 and (Ce,Y)O2

[c22] 22. A fuel cell system comprising:
a source of a first mixture comprising molecular oxygen and a compound having formula 1:
CH_3-O-R.....1
wherein R is alkyl, aryl, alkaryl, or arakyl;
a heat source that heats the first mixture to a sufficient temperature to form a second mixture comprising carbon monoxide and molecular hydrogen;
a solid oxide fuel cell having an anode and a cathode; and
a conduit for contacting the anode of the solid oxide fuel cell with the second gaseous mixture.

[c23] 23. The system of claim 22 wherein the compound having formula 1 is dimethyl ether.

[c24] 24. The system of claim 22 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 3.0.

[c25] 25. The system of claim 22 wherein the molar ratio in the first mixture of molecular oxygen to a compound

having formula 1 is from about 0.1 to about 1.0.

[c26] 26. The system of claim 22 wherein the second mixture further comprises methane.

[c27] 27. The system of claim 22 wherein the heat source heats the first mixture to a temperature of less than about 650°C.

[c28] 28. The system of claim 22 wherein the heat source heats the first mixture to a temperature of at least about 450°C.

[c29] 29. The system of claim 22 wherein the heat source heats the first mixture to a temperature of at least about 550°C.

[c30] 30. The system of claim 22 wherein the heat source heats the first mixture to a temperature of from about 550°C to about 650°C.

[c31] 31. The system of claim 22 wherein the anode comprises a nickel-containing cermet.

[c32] 32. The system of claim 22 wherein the anode comprises a component selected from the group consisting of nickel mixed with gadolina doped ceria, nickel mixed with yttria doped ceria zirconia, or nickel mixed with yttria doped zirconia.)O2

[c33] 33. A method for forming carbon monoxide and molecular hydrogen, the method comprising:
forming a first mixture comprising molecular oxygen and a compound having formula 1:
CH_3-O-R.....1
wherein R is alkyl, aryl, alkaryl, or arakyl; and
heating the first mixture to a sufficient temperature to form a second mixture comprising carbon monoxide and molecular hydrogen.

[c34] 34. The method of claim 33 wherein the step of heating the first mixture produces less than about 10 weight % water and less than about 10 weight % carbon dioxide of the total weight of the second mixture.

[c35] 35. The method of claim 33 wherein the compound having formula 1 is dimethyl ether.

[c36] 36. The method of claim 33 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 3.0.

[c37] 37. The method of claim 33 wherein the molar ratio in the first mixture of molecular oxygen to a compound having formula 1 is from about 0.1 to about 1.0.

[c38] 38. The method of claim 33 wherein the first mixture is

heated to a temperature of less than about 650°C.

[c39] 39. The method of claim 33 wherein the first mixture is heated to a temperature of at least about 450°C.

[c40] 40. The method of claim 33 wherein the first mixture is heated to a temperature of at least about 550°C.

[c41] 41. The method of claim 33 wherein the first mixture is heated to a temperature of from about 550°C to about 650°C.

[c42] 42. The method of claim 33 wherein the first mixture is formed by combining air and the compound having formula 1.

[c43] 43. The method of claim 33 wherein R is a C_{1-6} alkyl.